
Continuous subcutaneous insulin infusion vs multiple daily injections in children with type 1 diabetes: a systematic review and meta-analysis of randomized control trials

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CRD summary

This review concluded that in the short-term (up to 12 months), continuous subcutaneous insulin infusion (insulin pump) provided better control of type 1 diabetes than did multiple daily injections. As the authors stated, the limitations of the evidence, particularly the small numbers of trials and participants included, suggest that this conclusion should be treated with caution.

Authors' objectives

To compare the effects of continuous subcutaneous insulin infusion (insulin pump) versus multiple daily injections on glycaemic control in children with type 1 diabetes.

Searching

The authors searched MEDLINE, EMBASE, the Cochrane Database of Systematic Reviews and the Cochrane Central Register of Controlled Trials Register to October 2007. No language restrictions were imposed. Search terms were reported. Reference lists from relevant studies and review articles were checked. Only studies available as full peer-reviewed publications were included.

Study selection

Parallel group RCTs or randomised crossover studies comparing continuous subcutaneous insulin infusion (insulin pump) with multiple daily injections were eligible for the review. Trials had to last at least eight weeks. Participants were aged one to 21 years with a minimum duration of type 1 diabetes of three months. The primary review outcome was glycaemic control, defined as glycosylated haemoglobin level after 3 months and at the end of the study. Secondary outcomes were listed.

Average age of participants in included studies ranged from approximately four to 14 years. Study duration ranged from four to 12 months. Data reported here are from tables; different figures were reported in the text.

Two reviewers independently selected studies for the review.

Assessment of study quality

Study quality was assessed based on adequacy of randomisation and allocation concealment; blinding of investigators, participants, outcome assessors and data analysts; completeness of follow-up; and use of intention-to-treat (ITT) analysis.

Two reviewers independently assessed quality.

Data extraction

For continuous outcomes, group means and standard deviations were extracted and used to calculate the mean difference between treatment and control groups. For dichotomous outcomes, relative risks were calculated from numbers of participants and events in each group. Data from both periods of crossover studies were combined.

All reviewers extracted data independently using standard forms. Discrepancies were resolved by discussion. Study authors were contacted for additional information if necessary.

Methods of synthesis

Studies were pooled by meta-analysis and weighted by the inverse of the variance. It appears that a fixed-effect model

was used. Heterogeneity was assessed using the X^2 test and I^2 statistic. The authors did not test for publication bias because of the small number of studies found.

Results of the review

Six RCTs (including two crossover trials) with 165 participants were included. Three trials had an adequate randomisation method and two used ITT analysis but none reported adequate allocation concealment or use of blinding.

Glycaemic control was significantly better in the insulin pump group (continuous subcutaneous insulin infusion) compared with patients receiving multiple daily injections both at the end of the trial (five RCTs; pooled weighted mean difference for glycosylated haemoglobin -0.24, 95% CI: -0.41, -0.07) and at three months (three RCTs; pooled weighted mean difference -0.29, 95% CI: -0.47, -0.11). Heterogeneity was not significant.

Daily insulin dose was significantly lower in the insulin pump group (pooled weighted mean difference -0.22, 95% CI: -0.31, -0.14). This finding was based on three RCTs (74 participants) without significant heterogeneity.

The risk of diabetic ketoacidosis (reported in two RCTs) and severe hypoglycaemia (four RCTs) did not differ significantly between groups. Results for other outcomes were reported.

Authors' conclusions

In short-term treatment, continuous subcutaneous insulin infusion (insulin pump) therapy provided better glycaemic control than multiple daily injections and allowed insulin dosage to be reduced. These results should be approached with caution because of the methodological limitations of the included studies.

CRD commentary

The review had clear inclusion criteria. The authors searched a number of relevant sources without language restrictions. The review was restricted to peer-reviewed publications, which could have introduced publication bias. The authors did not attempt to assess the risk of publication bias. Validity was assessed using standard criteria and the limitations of the included trials were briefly discussed. Appropriate methods were used to reduce the risk of errors and bias during the review process. Adequate details of included studies were presented. Studies were pooled by meta-analysis for some outcomes. Statistical heterogeneity was assessed and found not to be significant. The authors' conclusions reflected the evidence presented but, as the authors noted, the limitations of the evidence (small numbers of trials and participants, inclusion of crossover trials) suggest that the trial results should be treated with caution.

Implications of the review for practice and research

Practice: The authors did not state any implications for practice.

Research: The authors stated that an objective questionnaire should be developed to assess quality of life in children with diabetes undergoing insulin therapy and that future studies assessing glycaemic control should have larger sample sizes.

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